

## **NATURAL BRIDGES NATIONAL PARK RESEARCH SUMMARY 2012**

**1) Study Title:** NCPN Integrated Riparian Monitoring in Natural Bridges National Monument

**Permit No.:** NABR-2012-SCI-0001

**Principle Investigator:** I&M NCPN

**Purpose of Scientific Study:** The National Park Service's Inventory and Monitoring Program (NPS I&M), in collaboration with 32 monitoring networks, are charged with monitoring natural resources. Vital signs represent a select set of physical, chemical and biological elements and processes of park ecosystems that are chosen to represent the overall health and condition of a park's resources. Together, the Northern and Southern Colorado Plateau Networks (NCPN and SCPN) have developed conceptual models of key ecosystems and identified an integrated set of vital signs for tracking resource conditions at 35 NPS units within or near the Colorado Plateau (Thomas et al. 2004, OâDell et al. 2005). Riparian systems are a high priority vital sign for the NCPN (OâDell et al. 2005). Riparian systems are disproportionately high in biodiversity relative to their spatial extent due to the year-round or at least frequent availability of water. In turn, healthy and natural riparian systems serve as a predictable source of water, and function to maintain the natural diversity of riparian-adapted plants and animals across the Colorado Plateau region. Various dynamics interact to influence riparian systems. Ground-water levels, flood disturbance intensity and frequency, plant population, dynamics, and even upland conditions and dynamics collectively interact to shape the in-stream conditions and vegetative features of a riparian zone. Monitoring the status and trends in representative attributes and effects of an array of patterns and processes is an overarching goal of the NCPN Integrated Riparian Monitoring effort. This effort is intended to provide park managers with information on the variability of riparian systems, and to provide early warning of system degradation. In the latter case, monitoring information can be used to determine the potential for mitigating actions, and where such actions are implemented, monitoring efforts can contribute to understanding the effects of these actions. Riparian monitoring occurs in Armstrong Canyon in NABR. Specific objectives of the overall riparian monitoring effort are to determine the status and trends in:

- 1) the areal extent, cover, species composition and structure of riparian vegetation
- 2) exotic plant species
- 3) channel morphology of surveyed cross sections and the channel thalweg
- 4) floodplain ground-water levels and stream flow/discharge

Procedures for riparian monitoring incorporated pieces of the USGS Water Quality Assessment Program (Moulton et al. 2002) and EMAP procedures (Kaufmann et al. 1999) and were initially developed by Scott and Reynolds (draft). Further refinement has been completed by NCPN staff and by Steve Monroe and Ellen Soles of the SCPN. NCPN riparian protocols have been submitted for peer review.

**Findings/Accomplishments for 2012:** NCPN field crews monitored riparian vegetation in two reaches in 2012 in Armstrong Canyon: Reach 2 was revisited and Reach 4 was established. A geomorphic survey using a total station was established in Reach 2. Reconnaissance of potential locations for hydrologic monitoring was also completed, and a pressure transducer that measures the stage of flash floods will be installed in 2013. Monitoring crews will return in 2013.

**2) Study Title:** Long-Term Changes in Colorado Plateau Ecosystems Using Repeat Photography

**Permit No.:** NABR-2012-SCI-0002

**Principle Investigator:** Robert Webb

**Purpose of Scientific Study:** Repeat photography is a long-established technique for documenting landscape change and estimating plant demographics, particularly in arid environments. Although remotely sensed imagery, such as Landsat or MODIS data, provides spatially rectified information, repeat photography can provide long-term, species-specific information that is extremely important for documenting the effects of land-use practices and climatic change. On the Colorado Plateau, where long-term ecological data from permanent plots is sparse, repeat photography is the best technique for documenting changes in shrublands and grasslands over the last century of climate variability.

Approximately 475 historical images of Canyonlands and Arches National Parks and Hovenweep and Natural Bridges National Monuments were collected in the early 2000s, and approximately 138 were matched between 2000 and 2006. The original photographs were taken as early as 1871 (Powell expedition) and 1874 (William Henry Jackson), and many originals were taken between 1905 and 1925 by U.S. Geological Survey geologists. We request funding to interpret landscape change and plant demographics for the already replicated photographs and to replicate selected additional imagery to provide data on specific types of ecosystems that are expected to be impacted by future climate changes.

**Findings/Accomplishments for 2012:** We didn't work at Natural Bridges in 2011.

**3) Study Title:** U.S. Historical Climatology Network Modernization (USHCN-M)

**Permit No.:** NABR-2010-SCI-0003

**Principle Investigator:** Dennis Atkinson

**Purpose of Scientific Study:** Support for the Department of Commerce (DOC), National Oceanic and Atmospheric Administration's (NOAA) U.S. Regional Climate Reference Network (USRCRN) program. The purpose of the USRCRN program is to provide a surface meteorological monitoring network that will allow scientists and the research community to have high quality data for use in climate evaluations and studies. These studies will allow determinations to be made with respect to regional climate signals, as they relate to different climate regimes. These climate studies will help predict and inform changes that affect humans, fauna, and flora, in addition to impacts on national, economic, and social infrastructures. This meteorological data will provide valuable on-site data for the National Park Service to monitor climate effects on sensitive elements throughout the parks and climate changes that affect the viability and use of the parks. The USRCRN program is designed to provide a consistent spatial coverage of meteorological monitoring data across the United States. Each grid point covers a radial out to 65km. One site per grid point is selected based on siting criteria and broader representation of the grid point characteristics. Sites which capture local or micrometeorological phenomenon are not appropriate to capture climate changes. Prior to selection, sites undergo a rigorous assessment and evaluation process, involving 3 NOAA line offices (NWS,OAR,NESDIS). Each site is selected by vote ballot, based on an array of criteria affecting the measurement of temperature and precipitation.

**Findings/Accomplishments for 2012:** This site is currently transmitting temperature and precipitation measurements. The latest data is available from the following URL:

<http://www.ncdc.noaa.gov/crn/usrcrn>

**4) Study Title:** NCPN Springs Monitoring in Natural Bridges National Monument

**Permit No.:** NABR-2012-SCI-0003

**Principle Investigator:** I&M NCPN

**Purpose of Scientific Study:** The National Park Service's Inventory and Monitoring Program (NPS I&M), in collaboration with 32 monitoring networks, are charged with monitoring natural resources. Vital signs represent a select set of physical, chemical and biological elements and processes of park ecosystems that are chosen to represent the overall health and condition of a park's resources. Together, the Northern and Southern Colorado plateau Networks (NCPN and SCPN) have developed conceptual models of key ecosystems and identified an integrated set of vital signs for tracking resource conditions at 35 NPS units within or near the Colorado Plateau (Thomas et al. 2004, OâDell et al. 2005).

Spring and seep systems are a high priority vital sign for the NCPN (OâDell et al. 2005). Spring and seep systems are disproportionately high in biodiversity relative to their spatial extent due to the year-round or at least frequent availability of water. Many springs are closely tied to regional climate and local weather patterns. Monitoring the status and trends of spring and seep ecosystems can provide park managers with information on the variability of spring and seep systems, early warnings of system degradation, and the impacts of climate change. Specific objectives of the springs and seeps monitoring effort are to determine the status and trends in:

- 1) water quantity
- 2) water pH and specific conductance
- 3) endemic plant counts
- 4) vegetation species composition and cover

Monitoring will also produce status information on water quality, exotic plant and animal species presence, and anthropogenic disturbance.

**Findings/Accomplishments for 2012:** Monthly water quantity and quality samples were collected at Upper Armstrong Spring for five months as pilot sampling for long-term monitoring. Pilot sampling indicated there was not enough flow at the site to warrant monthly sampling. A double observer pilot study of potential vegetation monitoring methods was completed at six randomly selected hanging gardens.

## **HOVENWEEP NATIONAL PARK RESEARCH SUMMARY 2012**

Study Title: Long-Term Changes in Colorado Plateau Ecosystems Using Repeat Photography

Permit No.: HOVE-2012-SCI-0001

Principle Investigator: Robert Webb

Purpose of Scientific Study: Repeat photography is a long-established technique for documenting landscape change and estimating plant demographics, particularly in arid environments. Although remotely sensed imagery, such as Landsat or MODIS data, provides spatially rectified information, repeat photography can provide long-term, species-specific information that is extremely important for documenting the effects of land-use practices and climatic change. On the Colorado Plateau, where long-term ecological data from permanent plots is sparse, repeat photography is the best technique for documenting changes in shrublands and grasslands over the last century of climate variability.

Approximately 475 historical images of Canyonlands and Arches National Parks and Hovenweep and Natural Bridges National Monuments were collected in the early 2000s, and approximately 138 were matched between 2000 and 2006. The original photographs were taken as early as 1871 (Powell expedition) and 1874 (William Henry Jackson), and many originals were taken between 1905 and 1925 by U.S. Geological Survey geologists. We request funding to interpret landscape change and plant demographics for the already replicated photographs and to replicate selected additional imagery to provide data on specific types of ecosystems that are expected to be impacted by future climate changes.

Findings/Accomplishments for 2012: We didn't work in Hovenweep in 2011.